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CLAIMS

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[Claim(s)]

[Claim 1] the inside of the atmospheric pressure atmosphere after putting in the raw material foam of the request configuration which consists of a closed-cell resin foam into the atmosphere decompressed from atmospheric pressure and making the inside of a closed cell into a reduced pressure state -- \*\*\*\* -- the manufacture method of the foam characterized by things

[Claim 2] the inside of the atmospheric pressure atmosphere after putting in the raw material foam of the request configuration which consists of a closed-cell resin foam into gas atmosphere where the gas permeability over the resin which constitutes this raw material foam is higher than air and making the aforementioned gas penetrate in a closed cell through a cellular film -- \*\*\*\* -- the manufacture method of the foam characterized by things

[Claim 3] the inside of the temperature atmosphere below the boiling point of this liquefied gas after putting in the raw material foam of the request configuration which consists of a closed-cell resin foam into the atmosphere of a liquefied gas and making the aforementioned liquefied gas penetrate in a closed cell through a cellular film -- \*\*\*\* -- the manufacture method of the foam characterized by things

[Claim 4] The manufacture method of the foam which a part of raw material foam [ at least ] of the request configuration which consists of a closed-cell resin foam is surrounded [ foam ] with the rubber elasticity object in the state where it was elongated, and shrinks a surrounding portion by the elastic force of a rubber elasticity object.

*Mizuy thermoplastic*

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the manufacture method of a foam.

[0002]

[Description of the Prior Art] Like the re-expansion nature plastics chip currently indicated by JP,62-13441,A, it consists of a closed-cell resin foam, it is once in the contraction state, and the foam which has the delayed configuration recoverability which a configuration recovers gradually by the elastic-recovery force of a resin and transparency of the air from the outside which lets a cellular film (cell film) pass to into a closed cell (cell) is already proposed.

[0003] That is, if this foam is at the contraction state time in order to be in the contraction state at the beginning, and for a configuration to swell in the direction of three dimensions gradually as mentioned above and to recover to the thickness of the original closed-cell resin foam before abbreviation contraction, it is not bulky and is excellent in conveyance or workability. And it becomes the thing equipped also with seal nature or adiathermancy, and promising \*\* is carried out by configuration recovery as a heat insulator, a sealant, etc.

[0004]

[Problem(s) to be Solved by the Invention] However, although the manufacture method of the above-mentioned conventional foam is satisfactory if it is only the foam of fixed forms, such as the shape of the shape of a sheet, or a rod By cooling this raw material foam and making an volatile organic blowing agent liquefy, after making the foaming raw material which made the volatile organic blowing agent contain heat and foam to a base-material resin and obtaining the raw material foam of a closed cell Since it is made to make it contract, when it is going to obtain the foam of a special configuration and is going to produce a wide variety in limited amounts by preparing the form block according to it, there is a problem said that a manufacturing cost increases.

[0005] In view of such a situation, even if this invention is the foam of a special configuration, it aims at offering the manufacture method of the foam which can be manufactured without applying a manufacturing cost.

[0006]

[Means for Solving the Problem] the inside of the atmospheric pressure atmosphere in order to attain such a purpose, after the manufacture method (it is hereafter described as "the manufacture method of a claim 1") of the foam concerning invention according to claim 1 putting in the raw material foam of the request configuration which consists of a closed-cell resin foam into the atmosphere decompressed from atmospheric pressure and making the inside of a closed cell into a reduced pressure state -- \*\*\*\* -- it was made like

[0007] In the manufacture method of the above-mentioned claim 1, although especially a raw material foam is not limited, it can carry out cutting in a request configuration etc., and can obtain the existing closed-cell resin foam, for example.

[0008] All configurations, such as the shape of a cylinder and a string and not only a tabular but the doll, are possible for the configuration of a raw material foam. As a reduced pressure atmosphere, it is 0.05-0.9atm at absolute pressure. A grade is desirable and it is 0.05-0.5atm. A grade is more desirable.

[0009] Namely, 0.05atm When less and a raw material foam is \*(ed) in atmospheric pressure atmosphere, there is a possibility that the great portion of deformation of the resin itself may turn into [ a contraction ] plastic deformation large, and configuration recoverability may become bad. Moreover, 0.9atm When it exceeds, there is a possibility that it may not fully contract. Moreover, a load may be applied in the predetermined direction, or position fixation is carried out and you may make it regulate the edge of the predetermined direction in atmospheric pressure atmosphere in the \*\*\*\* case.

[0010] That is, the contraction direction is controllable with the compulsory compression or regulation from predetermined. In addition, although it can adjust by adjusting the both sides of time which are \*(ing) the degree of reduced pressure, and the raw material foam in reduced pressure atmosphere, since the degrees of contraction of the foam obtained differ in the configuration of the kind of resin which constitutes a raw material foam, i.e., a closed-cell resin foam, an expansion ratio, the rate of a closed cell, the path (size) of a closed cell, the cellular film thickness of a closed cell, and a raw material foam etc., it is desirable [ the degrees ] to conduct

[0011] the inside of the atmospheric-pressure atmosphere after putting in the manufacture method (it is hereafter described as "the manufacture method of a claim 2") of the foam concerning invention according to claim 2 into gas atmosphere where the gas permeability over the resin which constitutes this raw material foam for the raw material foam of the request configuration which consists of a closed-cell resin foam is higher than air and making the aforementioned gas penetrate in a closed cell through a cellular film -- \*\*\*\* -- it was made like

[0012] In the manufacture method of the above-mentioned claim 2, especially as gas A, although not limited, when a resin is a low density polyethylene for example, carbon dioxide gas, helium, an argon, water, a krypton, a xenon, etc. are desirable.

[0013] In the atmosphere of Gas A, in the \*\*\*\* case, a raw material foam may be pressurized from atmospheric pressure, and Gas A may be heated for it. That is, if it pressurizes or heats, transparency into the closed cell of Gas A will become quick. In addition, under the softening temperature (let [ non-crystalline polymer ] the melting point be softening temperature about a glass transition point and crystalline polymer) of heating of the resin which constitutes a raw material foam is desirable. When softening temperature is exceeded, there is a possibility that a closed cell may deform or it may be destroyed.

[0014] Although it can adjust a raw material foam by adjusting the pressure and temperature of \*\*\*\* time and Gas A into gas A atmosphere, since the degree of contraction of the foam obtained changes, respectively with configurations of the kind of resin which constitutes a raw material foam, an expansion ratio, the rate of a closed cell, the path of a closed cell, the cellular film thickness of a closed cell, and a raw material foam etc., it is desirable to conduct preliminary experiment. Moreover, a load may be applied in the predetermined direction, or position fixation of the edge of the predetermined direction is carried out, and you may make it regulate the contraction direction in atmospheric pressure atmosphere like the manufacture method of a claim 1 in the \*\*\*\* case.

[0015] the inside of the temperature atmosphere below the boiling point of this liquefied gas after the manufacture method (it is hereafter described as "the manufacture method of a claim 3") of the foam concerning invention according to claim 3 having put in the raw material foam of the request configuration which consists of a closed-cell resin foam into the atmosphere of a liquefied gas and making the aforementioned liquefied gas penetrate in a closed cell through a cellular film -- \*\*\*\* -- it was made like

[0016] In the manufacture method of a claim 3 as a liquefied gas If it is as follows [ the softening temperature of the resin with which it liquefies by cooling and the boiling point constitutes a raw material foam ] Although not limited especially, when a resin is a low density polyethylene (softening temperature of 110 degrees C), for example Alcohols, such as a methanol (boiling point of 64.51 degrees C), and ethanol (boiling point of 78.32 degrees C), Ketones, such as an acetone (boiling point of

56.5 degrees C), a pentane (boiling point of 36.07 degrees C), Aromatic hydrocarbons, such as aliphatic hydrocarbon, such as a hexane (boiling point of 68.74 degrees C), and benzene (boiling point of 80.1 degrees C) Halogenated hydrocarbons, such as ether [ , such as ethyl ether (boiling point of 34.48 degrees C), ], 1, and 1-dichloro-1-fluoro ethane (boiling point of 32.1 degrees C), water (boiling point of 100 degrees C), etc. are mentioned.

[0017] In the \*\*\*\*\* case, you may pressurize a liquefied gas for a raw material foam from atmospheric pressure in liquefied gas atmosphere. That is, if it pressurizes, transparency into the closed cell of a liquefied gas will become quick. Moreover, as for a liquefied gas, it is desirable to heat to the temperature of under the softening temperature of the resin which constitutes a raw material foam above the boiling point. That is, as for the liquefied gas penetrated into a closed cell as it is the temperature below the boiling point, only the amount of saturated vapor pressure is, and it requires time for attaining the target degree of contraction. Moreover, when softening temperature is exceeded, there is a possibility of causing deformation and destruction of a closed cell.

[0018] Although they can adjust a raw material foam by adjusting the pressure and temperature of \*\*\*\*\* time and a liquefied gas into liquefied gas atmosphere, since the degrees of contraction of the foam obtained differ in the configuration of the kind of resin which constitutes a raw material foam, an expansion ratio, the rate of a closed cell, the path of a closed cell, the cellular film thickness of a closed cell, and a raw material foam etc., it is desirable to conduct preliminary experiment. Moreover, since contraction starts simultaneously with cooling, it responds required at this time, and position fixation of the edge of the predetermined direction is carried out, and you may make it apply a load in the predetermined direction like the manufacture method of a claim 1 and a claim 2, or regulate the contraction direction.

[0019] The manufacture method (it is hereafter described as "the manufacture method of a claim 4") of the foam concerning invention according to claim 4 surrounds a part of raw material foam [ at least ] of the request configuration which consists of a closed-cell resin foam with the rubber elasticity object in the state where it was elongated within the elasticity limit, and it was made to make it contract it in the elastic-deformation field of the resin which constitutes a raw material foam according to the elastic stability of a rubber elasticity object.

[0020] In the manufacture method of the above-mentioned claim 4, as a rubber elasticity object, if a modulus (tensile stress) is more than the compressive stress of the raw material foam of a surrounding portion, it will not be limited especially. As the quality of the material of a rubber elasticity object, for example Natural rubber, a nitrile rubber (NR), A styrene butadiene rubber (SBR), nitril-butadiene rubber (NBR), Chloroprene rubber (CR), isobutylene isoprene rubber (IIR), ethylene-propylene rubber (EPM), (Polyisoprene-rubber IR) (butadiene rubber BR) chloro sulfonation polyethylene rubber (CSM), Polyurethane rubber, silicone rubber, a fluororubber, a chlorinated butyl rubber, an acrylic rubber, What was vulcanized if needed [ , such as multi-sulfuration gum and an epichlorohydrin rubber, ], various thermoplastic elastomer (an olefin system, an urethane system, styrene system, etc.), such mixture, etc. are mentioned.

[0021] Moreover, you may make it add the additive currently used for the usual rubber compound on the above-mentioned rubber elasticity object if needed. If surrounding of a desired portion is possible for the configuration of a rubber elasticity object, the shape of the shape of the shape of a string, band-like, and a ring and a tube, especially a saccate, etc. will not be limited.

[0022] In addition, in order to shrink a raw material foam from a hoop direction equally in two dimensions, the ends of the shaft orientations of a raw material foam carry out opening, it is smaller than a raw material foam, and in order to shrink a raw material foam equally in three dimensions using the rubber elasticity object of the shape of a tube which considered the analog as the raw material foam, it is smaller than a raw material foam, and it is desirable to use the rubber elasticity object of the saccate which considered the analog as the raw material foam.

[0023] Moreover, whole homogeneity is sufficient as the thickness of a rubber elasticity object, and you may make it change it partially.

[0024] Furthermore, before surrounding with a rubber elasticity object if needed, like the manufacture

method of a claim 2 or a claim 3, it may put in into liquefied gas or gas A atmosphere, and the gas in a closed cell may be changed to a liquefied gas or Gas A. That is, contraction becomes quicker. In addition, when compressing a raw material foam, the temperature at the time of compression is below the softening temperature of the resin which constitutes a raw material foam. That is, when compressing at the temperature more than softening temperature, there is a possibility that the configuration recovery ability of the foam after \*\*\*\* may be lost.

[0025] In the manufacture method of the above-mentioned claims 1-4, although the rate of a closed cell of a raw material foam is decided by the amount of recovery needed as a foam which it is going to obtain and is not limited especially, it is desirable. [ 60% - 100% of ] Moreover, especially as a resin which constitutes a raw material foam, although not limited, a compression set (based on JIS K 6767) is 20% or less of thing especially excellent [ 10% or less of ] in configuration recoverability, and desirable.

[0026] As such a resin, following thermoplastics or following thermosetting resin mentions, and it is \*\*\*\*.

[0027] [Thermoplastics] Olefin system resins, such as polyethylene, polypropylene, an ethylene propylene rubber, an ethylene-propylene-diene copolymer, and an ethylene vinylacetate copolymer, Acrylic resins, such as poly methyl acrylate, the poly methyl meta-crate, and an ethylene-ethyl acrylate copolymer, Styrene resins, such as a styrene-butadiene-rubber, acrylonitrile-styrene, styrene, styrene-styrene-butadiene-rubber, styrene-isoprene-styrene, and styrene-acrylic acid, Vinyl chloride system resins, such as acrylonitrile-polyvinyl chloride and polyvinyl chloride-ethylene, Fluoride vinyl system resins, such as the poly fluoride vinyl and a polyvinylidene fluoride, Amide resins, such as 6-nylon, 6 and 6-nylon, and 12-nylon, Saturation ester system resins, such as a polyethylene terephthalate and a polybutylene terephthalate, A polycarbonate, a polyphenylene oxide, a polyacetal, a polyphenylene sulfide, silicone resin, a thermoplastic urethane resin, a polyether ether ketone, polyether imide, various elastomers, and these bridge formation objects.

[0028] [Thermosetting resin] Hardened material of an epoxy system resin, a phenol system resin, a melamine system resin, an urethane system resin, an imido \*\* resin, a urea system resin, a silicone system resin, and a unsaturated-polyester system resin etc.

[Natural resin] Even if it uses independently, you may use together two or more sorts of these resins [, such as a sap, ], such as natural rubber, a cellulose, starch, protein, and Japanese lacquer, in addition.

[0029] Moreover, an olefin system resin, a styrene resin, an amide system resin, an acrylic copolymer, elasticity polyurethane, a soft polyvinylchloride resin, a polyacetal, silicone resin, and especially various elastomers are mentioned also in the above-mentioned resin as what is excellent in especially configuration recoverability. Well-known methods including the method indicated by the plastic foam handbook are mentioned, and which method may be used for the foaming method.

[0030] As a foaming agent used at the time of the manufacture of a closed-cell resin foam used as a raw material foam Although not limited especially, as a foaming agent of a resolvable type, for example An azo JIKARUBO amide (ADCA), An azobisisobutyronitril (azobisuisobutironitoriru), a dinitrosopentamethylenetetramine (DPT), p-tosyl hydrazide (thyroid stimulating hormone) and a benzenesulphonyl hydrazide (BSH) -- and A sodium bicarbonate etc. is mentioned and volatile liquids, such as gases, such as carbon-dioxide-gas, propane, methyl-ether, pentane, 1, and 1-dichloro-1-fluoro ethane, and the ether, the petroleum ether, an acetone, and ethanol, are mentioned as a volatilized type foaming agent.

[0031] Moreover, you may add the foaming assistant which adjusts foaming speed with these foaming agents. Incidentally, as a foaming assistant which speeds up [ foaming ], acids, such as mineral salt, such as metallic soaps, such as a zinc stearate and a calcium stearate, a zinc white, and zinc nitrate, an adipic acid, and oxalic acid, are mentioned, and tin compounds, such as organic acid anhydrides, such as organic acids, such as a maleic acid and a phthalic acid, a maleic anhydride, and phthalic anhydride, dibutyltin maleate, and chlorination tin, are mentioned as a foaming assistant delayed in foaming speed.

[0032] Although a foaming assistant changes with kinds of the resin to be used, a foaming agent, and assistant, it is desirable to usually be added at an addition rate about 0.1 - 2 weight section to the

thermoplastics 100 weight section. That is, the effect of an addition will be small in below the 0.1 weight section, it will be in a saturation state above 2 weight sections, and there is a possibility that the addition effect beyond it may be lost.

[0033] Moreover, the above-mentioned raw material foam may mix a bulking agent, reinforcement fiber, the coloring agent, the ultraviolet ray absorbent, the antioxidant, the flame retarder, etc. if needed. As a bulking agent, a calcium carbonate, talc, clay, a magnesium oxide, a zinc oxide, carbon black, a silicon dioxide, titanium oxide, a glass powder, a glass bead, etc. are mentioned, for example.

[0034] As reinforcement fiber, a glass fiber, a carbon fiber, etc. are mentioned, for example. As a coloring agent, pigments, such as titanium oxide, are mentioned, for example. As an antioxidant, by generally using, if it is a \*\*\*\* thing, it will not be limited especially, for example, tetrakis [methylene (3, 5-G t-butyl-4-hydroxy hydro cinnamate)] methane, a dilauryl thiodipropionate, 1 and 1, 3-tris (2-methyl-4-hydroxy-5-t-buthylphenyl) butane, etc. are mentioned.

[0035] As a flame retarder, one sort or two sorts or more of mixture, such as \*\* phosphoric-acid system flame retarders, such as bromine system flame retarders, such as a hexa BUROMO phenyl ether and decabromodiphenyl ether, an ammonium polyphosphate, trimethyl phosphate, and triethyl phosphate, a melamine derivative, and an inorganic system flame retarder, is mentioned.

[0036]

[Embodiments of the Invention] The gestalt of operation of this invention is explained to it in detail, referring to a drawing to below. Drawing 1 expresses the gestalt of implementation of the manufacture method of a claim 1. the existing closed-cell resin foam which consists of a low-density-polyethylene resin etc. as this manufacture method is first shown in drawing 1 (a) -- cutting -- for example, the doll of a bear -- raw material foam 1a [ like ] is manufactured

[0037] Next, as shown in drawing 1 (b), this raw material foam 1a is put in in the decompression chamber 2 held from atmospheric pressure at the pressure of a low request. Namely, if raw material foam 1a is \*\*(ed) in reduced pressure atmosphere in a decompression chamber 2, through the cellular film of a closed cell, the gas in a closed cell falls out gradually, appears in a decompression chamber 2 side, and the inside of a closed cell will also be in a reduced pressure state.

[0038] and raw material foam 1a is taken out from a decompression chamber 2 after predetermined-time neglect in a decompression chamber 2, and it is indicated as \*\*\*\* in atmospheric pressure atmosphere at drawing 1 (c) -- as -- raw material foam 1a -- atmospheric pressure -- three dimensions ---like -- contracting -- the raw material foam 1 and abbreviation -- the doll of the bear of an analog -- foam 1b [ like ] is obtained Thus, if obtained foam 1b is left in atmospheric pressure, it will be gradually recovered in the thickness of a basis, balancing with the inside-and-outside pressure of a foam according to the elastic-recovery force of a resin, and, finally a configuration will recover it gradually in the configuration of raw material foam 1a of origin mostly.

[0039] According to this manufacture method, the foam of various configurations which has the delayed configuration recoverability can be obtained only by carrying out cutting of the existing closed-cell resin foam to a desired configuration, without applying facility cost, such as preparing various form blocks. That is, it excels in limited-production-with-a-wide-variety nature. and -- above -- a doll -- a configuration [ like ], then sewing-basis from which a configuration and a size change every day -- it can be used as a toy [ like ] or an interior

[0040] Moreover, if it puts into a decompression chamber 2 again and same processing is performed even if it once carries out configuration recovery, it can be used repeatedly. After the gestalt of implementation of the manufacture method of a claim 2 obtains the raw material foam of a request configuration like the manufacture method of the above-mentioned claim 1, Carbon dioxide gas with the high permeability to the resin which replaces with the decompression chamber 2 of the manufacture method of a claim 1, and constitutes a raw material foam from air, After putting in a predetermined-time raw material foam into the gas bottle gas A, such as helium, an argon, a krypton, and a xenon, was [ gas bottle ] full of desired concentration, a raw material foam is \*\*(ed) in atmospheric pressure atmosphere, and is shrunk.

[0041] That is, by putting in predetermined time into the gas bottle Gas A was [ gas bottle ] full of the

raw material foam with desired concentration, Gas A enters into the closed cell of a raw material foam through a cellular film, and the gas A concentration in a closed cell becomes high. the raw material foam to which the gas A concentration in a closed cell next fully became high -- although the gas A in a closed cell penetrates the air besides a closed cell out of a closed cell according to \*\*\*\*\* and a partial pressure difference in atmospheric pressure atmosphere to a closed cell, since the transmission rate of Gas A is quicker than the transmission rate of air, the inside of a closed cell will be in a reduced pressure state

[0042] Therefore, like foam 1b of drawing 1 (c), a closed cell can contract with atmospheric pressure and a raw material foam can obtain the foam of the request which has configuration recoverability. The obtained foam carries out configuration recovery gradually like manufacture method 1b of a claim 1 after that at the configuration of the original raw material foam.

[0043] After the gestalt of implementation of the manufacture method of a claim 3 puts in a predetermined-time raw material foam into the gas bottle which it replaced with the decompression chamber 2 of the manufacture method of a claim 1, and the evaporated liquefied gas was [ decompression chamber ] full of after obtaining the raw material foam of a request configuration like the manufacture method of the above-mentioned claim 1, it \*\* a raw material foam in the temperature atmosphere below the boiling point of a liquefied gas, and is made to contract it.

[0044] That is, by putting in predetermined time into the gas bottle the liquefied gas was [ gas bottle ] full of the raw material foam with desired concentration, a liquefied gas enters into the closed cell of a raw material foam through a cellular film, and the liquefied gas concentration in a closed cell becomes high.

[0045] Next, the liquefied gas in \*\*\*\*\* and a closed cell liquefies the raw material foam to which the liquefied gas concentration in a closed cell fully became high in the temperature atmosphere below the boiling point of a liquefied gas, the pressure in a closed cell will be in a reduced pressure state from atmospheric pressure, like foam 1b of drawing 1 (c), a closed cell can contract with atmospheric pressure and a raw material foam can obtain the foam of the request which has configuration recoverability.

[0046] The obtained foam carries out configuration recovery gradually like foam 1b of the manufacture method of a claim 1 after that at the configuration of the original raw material foam.

[0047] The gestalt of implementation of the manufacture method of a claim 4 is surrounded with the rubber elasticity object which expanded the request portion of the raw material foam which cut the existing closed-cell resin foam and was made into the desired configuration. And the portion surrounded with the rubber elasticity object is compressed by the elastic stability of a rubber elasticity object with a rubber elasticity object, and a raw material foam turns into a foam which has the configuration recoverability which the request portion contracted.

[0048] That is, if cylindrical raw material foam 3a is put in from this raw material foam 3a in a minor diameter in the rubber elasticity object tube 4 of raw material foam 3a and a similarity configuration and raw material foam 3a is surrounded from a hoop direction with the rubber elasticity object tube 4 as shown in drawing 2 (a), the rubber elasticity object tube 4 into which raw material foam 3a was put and whose diameter was expanded to the path of a raw material foam at the beginning will compress raw material foam 3a from a hoop direction according to the elastic stability. And if the rubber elasticity object tube 4 is removed after carrying out predetermined-time neglect, as shown in drawing 2 (b), it contracted from the whole hoop direction, namely, foam 3b contracted in two dimensions can be obtained.

[0049] Moreover, foam 3c of the configuration of the rubber elasticity object tube 5 where cylindrical raw material foam 3a is shown in drawing 3 (b) if the inside of the rubber elasticity object tube 5 of a different diameter is put in like drawing 3 (a) is obtained. This foam 3c carries out configuration recovery gradually, and becomes the shape of an original pillar. Furthermore, if the raw material foam 6 which carried out the globular form is put in in the rubber elasticity object 7 of the saccate which carried out the spherical of a minor diameter from the raw material foam 6 as shown in drawing 4 (a), compressive force can be equally added from the perimeter side of the raw material foam 6, and the



foam contracted in three dimensions while it had been spherical can be obtained.

[0050] If the raw material foam 6 is put into saccate main part 81 portion which carried out the cube form of the rubber elasticity object 8 as shown in drawing 4 (b), although the foam of a cube form can be obtained on the other hand, this foam carries out configuration recovery gradually, and returns spherically [ origin ]. As mentioned above, according to the manufacture method of a claim 4, the foam of various configurations which has the configuration recoverability delayed easily can be obtained only by carrying out cutting of the existing closed-cell resin foam to a desired configuration, without applying facility cost, such as preparing various form blocks.

[0051]

[Example] Below, the example of this invention is explained in detail.

(Example 1) After leaving the spherical closed-cell resin foam with a diameter of 80mm which cut and obtained the closed-cell resin foam made from a low density polyethylene ( soft loan board by Sekisui Chemical Co., Ltd., the thickness of 90mm, 30 times as many expansion ratio as this) in the decompression chamber of 25 degrees C and 50mmHg for 12 hours, when it took out from the decompression chamber, it contracted and became a 10 times as many expansion ratio as this and a foam with a diameter of 26mm.

[0052] The configuration was recovered gradually and this foam became a spherical with a diameter of 72mm after about 80 days. Moreover, the expansion ratio at this time was 27 times.

[0053] (Example 2) It is the closed-cell resin foam with a rectangle of 100x100x90mm which cut and obtained the closed-cell resin foam made from a low density polyethylene ( soft loan board by Sekisui Chemical Co., Ltd., the thickness of 90mm, 30 times as many expansion ratio as this) 25 degrees C and 10 kg/cm<sup>2</sup> It is 2kg [ 5 //cm ] to the ejection thickness direction after putting in into the container full of carbon dioxide gas and leaving it for 24 hours. The foam was obtained having applied the load.

[0054] The foam which removed the load and was obtained was 100x100x20mm. When this foam was left for 60 days under the ordinary temperature ordinary pressure, thickness carried out configuration recovery of it to 64mm.

[0055] (Example 3) They are 2 kg/cm<sup>2</sup> to the ejection thickness direction after putting in the closed-cell resin foam with a rectangle of 100x100x90mm which cut and obtained the closed-cell resin foam made from a low density polyethylene ( soft loan board by Sekisui Chemical Co., Ltd., the thickness of 90mm, 30 times as many expansion ratio as this) into the container which is 50 degrees C with which the pentane was filled and leaving it for 24 hours. Applying a load, it cooled with 20-degree C cold water, and the foam be

[0056] The foam which removed the load and was obtained was 100x100x30mm. When this foam was left for 60 days under the ordinary temperature ordinary pressure, thickness carried out configuration recovery of it to 69mm.

[0057] (Example 4) Low density polyethylene (the Mitsubishi Petrochemical Co., Ltd. make and 112.5 degrees C of ZH51 melting points) The MI=2.8 100 weight section and the talc ( MS by Japanese talc company) 1 weight section Vent type set as 130 degrees C It supplies to the hopper of phi65mm extruder (ratio-of-length-to-diameter=36). It pressed fit so that it might become per resin constituent 100 weight section and 12 weight sections from the vent section about a monochlorodifluoromethane, and extrusion foaming was carried out to the shape of a rod from the phi3.5mm mouthpiece set as 105 degrees C by the discharge quantity of 30 kg/hr, and the closed-cell resin foam was obtained. For the expansion ratio, 30 times and the path were [ 30mm and the rate of a closed cell of the obtained closed-cell resin foam ] 88%.

[0058] After putting in in the rubber elasticity object tube (the NBR base, 200% modulus 105kgf/cm<sup>2</sup>, 300% modulus 160 kgf/cm<sup>2</sup>, initial thickness of 100 micrometers, 10mm of diameters) by having made this closed-cell resin foam into the raw material foam and leaving it for 10 hours, when the rubber elasticity object was removed, the foam with a diameter of 20mm which the raw material foam contracted in two dimensions from the whole hoop direction was obtained.

[0059] When this foam was left for 30 days under the ordinary temperature ordinary pressure, configuration recovery was carried out to a 29 times as many expansion ratio as this and 28mm of



diameters.

[0060] (Example 5) The closed-cell resin foam made from a low density polyethylene ( soft loan board by Sekisui Chemical Co., Ltd., the thickness of 90mm, 30 times as many expansion ratio as this) was cut, and the spherical raw material foam with a diameter of 60cm was obtained. After putting this raw material foam into the spherical bag form rubber elasticity inside of the body with a diameter of 20mm which carried out the same thickness and leaving it with the same quality of the material as an example 4 for 48 hours, when it took out from the rubber elasticity object, it had become a spherical foam with a diameter of 42mm.

[0061] When this foam was left for 60 days under the ordinary temperature ordinary pressure, configuration recovery was carried out at the spherical with a diameter of 57mm.

[0062] (Example 1 of comparison)

- Styrene acrylonitrile copolymer (the Asahi Chemical Industry Co., Ltd. make, the SURAI rack AS 769) The 100 weight sections and talc ( MS by the Japanese talc company) The resin constituent which comes to blend the 0.2 weight sections was fed into the hopper of a screw extruder (phi50mm, ratio-of-length-to-diameter=30), and melting kneading was carried out within the extruder. In addition, the cylinder temperature of an extruder was set as 190 degrees C, 205 degrees C, 220 degrees C, and 220 degrees C toward the extruder nose of cam from the hopper.

[0063] It fully cooled until it supplied trichloromonofluoromethane as a foaming agent at a rate of 32g per 100g of above-mentioned resin constituents and next became 100 degrees C from the foam pouring section prepared in the screw point succeedingly, and it extruded with the extrusion outlet of 5 kg/h in the shape of a strand from the mouthpiece with diameter phi0.8mm nozzle many, and the pellet-like non-foamed particle with a diameter [ of 1mm ] and a length of 3mm was immediately obtained by cooling SHI and the cutter.

[0064] It is this pellet-like non-foamed particle at a room temperature After digestion neglect and gage pressure 0.3 kg/cm<sup>2</sup> After heating for 45 seconds and making it foam in steam atmosphere, when the obtained foam was cooled at 10 degrees C, the foam in which a foam carries out natural contraction in the direction of after [ 10 minutes ] three dimension, and has configuration recoverability was obtained.

[0065] For 3.3mm and length, 9.5mm and the expansion ratio were [ the diameter / 35.5 times and the rate of a closed cell of the obtained foam ] 92%. When this foam was left for 30 days under the ordinary temperature ordinary pressure, 5.5mm was recovered by the diameter and the configuration was recovered by length in [ 16mm and an expansion ratio ] three dimensions up to 164 times. In addition, in the above-mentioned examples 1-5 and the example 1 of comparison, it asked for the expansion ratio and the rate of a closed cell as follows.

[0066] [Expansion ratio] While starting a 35mm long and 35mm wide wafer from the obtained foam, sinking in the measuring cylinder with which the wafer was put into water and measuring the volume A, the weight is measured using an electronic balance. And the weight of the obtained foam is <sup>\*\*</sup>(ed) by the volume A of the wafer of a foam, the density of a foam is computed, and it asks by the formula of the density / foaming density of the resin expansion-ratio = Used.

[0067] [Rate of a closed cell] Volume B (closed-cell volume + resin volume) is measured using air relation aerometer 1000 type (the Tokyo Saiensu-Sha Co., Ltd. make) by 1 - 1/2 - 1 atmospheric-pressure method. And it asks by the formula of rate of closed cell =(density of volume B-weight / resin)/(density of a volume A-weight / resin).

[0068] Moreover, it investigated about the seal nature and workability of a foam which were obtained in the above-mentioned examples 2, 3, and 4 and the example 1 of comparison, and the result was shown in Table 1.

[0069] In addition, as for seal nature, examples 2 and 3 insert a foam 55 in a square case section (L1 =100mm, L2=100mm, and L3 =50mm) 51, respectively, as shown in drawing 5 . After leaving it for 60 days, when the leakage of the water from the drain pipe 53 when letting water flow toward the drain pipe 53 prepared in the lower part of a square case section 51 from the water flow pipe 52 formed so that it might intersect perpendicularly with a square case section 51 at the upper part was investigated, there was no leakage and there were O and leakage, it considered as x. When leakage of the water from the

drain pipe 63 when letting water flow toward the drain pipe 63 prepared in the lower part of the water flow pipe 62 prepared so that it might intersect perpendicularly with the square case section 61 after an example 4 and the example 1 of comparison inserting a foam 65 in the cylinder part 61 with a diameter of  $R=25\text{mm}$ , respectively as shown in drawing 6, and leaving it for 60 days at the upper part to the square case section 61 was investigated, there was no leakage and there were O and leakage, it considered as x

[0070] On the other hand, workability evaluated the workability when inserting each foam 55 and 65 in a square case section 51 or a cylinder part 61.

[0071]

[Table 1]

	シール性	施工性
実施例 2	○	○
実施例 3	○	○
実施例 4	○	○
比較例 1	×	○

[0072]

[Effect of the Invention] Since it is constituted as mentioned above, the manufacture method of the foam concerning this invention can be manufactured without applying a manufacturing cost, even if it is the foam of a special configuration. Of course, since it has the delayed configuration recoverability, when using it as shock absorbing material, a heat insulator, and a sealant, the obtained foam has good workability and it is very useful as a building material.

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[Translation done.]